VI. *Experiments of the Luminous Qualities of* Amber, Diamonds, *and* Gum Lac, *by Dr.* Wall, *in a Letter to Dr.* Sloane, R. S. Secr.

SIR,

HAVING lately obſerv'd ſeveral natural ſolid *Noctiluca*'s, not hitherto by any, as I know, taken notice of, (I think I may be well aſſur'd ſome of the *Phænomena* never were,) at your Requeſt I give you the larger account of 'em: But, before I ſpeak of my own Obſervations, give me leave to inform you a little concerning the Artificial *Phoſphorus*, which, you know, is a Subject I'm pretty well acquainted with, having made a great number of Experiments about it, whereby I was naturally led to the following Remarks.

You may remember my telling you many Years ago of my good Friend Mr. *Boyle*'s communicating to me, about the Year 1680, his way of making the *Phoſphorus* with Urine, at the ſame time deſiring me to uſe all my Endeavours to find out ſome other Subject, from whence it might be made in greater Quantity, and perhaps he might have made the like Requeſt to many more; for, to uſe his own Words, he ſaid, he really pitty'd his Chymiſt, who was forc'd to evaporate ſo prodigious a Quantity of Urine, to get a very little of the *Phoſphorus*. Soon after, in order to ſee ſome Experiments in Chymiſtry, I lodg'd for a ſhort time at his Chymiſt's Houſe, one Mr *Bilgar*, then living in *Mary-le-Bone* Street near *Piccadilly*, who indeed was equally, if not more importunate with me than Mr. *Boyle*, to try if I cou'd find out ſome other

other Matter, from which more might be made than from Urine, telling me there was ſo great a demand for it, that it wou'd be of very great advantage to him. It being then a very hot Summer, I cauſed a piece of the dry'd Matter in the Fields, where they empty the Houſes of Office, to be digg'd up, in which, when broken in the Dark, a great number of ſmall Particles of *Phoſphorus* appear'd: This Matter I carry'd to Mr. *Boyle*, who view'd it with great Satisfaction, and Mr. *Bilgar*, by his Direction, fell to Work thereon, but from it cou'd make very little or no *Phoſphorus*, till another Matter was added to it in Diſtillation, and then he cou'd therewith make large Quantities, to his great Profit; for while I was at his Houſe, I often ſaw him make it, and ſell it for ſix Guineas, and ſix *Louis d'Ors* an Ounce, whereby he got ſo much Money, that, I believe, he thought himſelf above his Buſineſs, and quickly left *England*; ſo that we loſt an Honeſt and Ingenious Chymiſt, and Mr. *Boyle* a Faithful and Induſtrious Servant. I forbear to mention the aboveſaid Matter in kindneſs to Mr. *Godfrey*, who ſucceeded Mr. *Bilgar* as Chymiſt to Mr. *Boyle*, and is the only Perſon, that I know of, who now makes it.

Now, *Sir*, my being, as you have heard, well acquainted with the Artificial *Phoſphorus*, was the occaſion of my making many Reflections about it, and caus'd me to conſider, whether there might not be *in rerum naturâ* other natural ones, beſides thoſe that Mr. *Boyle* and ſome others have given an account of.

You well know, *Sir*, that Humane Urine and Dung do plentifully abound with an *Oleoſum* and Common Salt, ſo that I take the Artificial *Phoſphorus* to be nothing elſe but that Animal *Oleoſum*, coagulated with the Mineral Acid of Spirit of Salt, which *Coagulum* is preſerv'd and not diſſolv'd in Water, but accended by Air.

Theſe

Theſe Conſiderations made me conjecture that *Amber*, which I take to be a Mineral *Oleoſum* coagulated with a Mineral Volatile Acid, might be a Natural *Phoſphorus*, ſo I fell to make many Experiments upon it, and at laſt found, that by gently rubbing a well poliſh'd Piece of Amber with my Hand in the dark, which was the Head of my Cane, it produc'd a Light; whereupon I got a pretty large piece of Amber, which I cauſed to be made long and taper, and drawing it gently thro' my Hand, being very dry, it afforded a conſiderable Light. I then us'd many Kinds of ſoft Animal Subſtances, and found none did ſo well as that of Wool. And now new *Phænomena* offered themſelves; for upon drawing the piece of Amber ſwiftly thro' the Woollen Cloth, and ſqueezing it pretty hard with my Hand, a prodigious number of little Cracklings were heard, and every one of thoſe produc'd a little flaſh of Light; but when the Amber was drawn gently and ſlightly thro' the Cloath, it produc'd a Light but no Crackling; but by holding one's Finger at a little diſtance from the Amber, a large Crackling is produc'd, with a great flaſh of Light ſucceeding it, and, what to me is very ſurprizing, upon its eruption it ſtrikes the Finger very ſenſibly, whereſoever apply'd, with a puſh or puff like Wind. The Crackling is full as loud as that of Charcoal on Fire; nay, five or ſix Cracklings, or more, according to the quickneſs of placing the Finger, have been produc'd from one ſingle Friction, Light always ſucceeding each of 'em. Now I make no queſtion, but upon uſing a longer and larger piece of Amber, both the Cracklings and Light would be much greater, becauſe I never yet found any Crackling from the Head of my Cane, altho' 'tis a pretty large one; and it ſeems, in ſome degree, to repreſent Thunder and Lightning; but what to me is more ſtrange than all I have been telling you is, that tho' upon friction with Wool in the day time, the Cracklings ſeem to be full as many and

as large, yet by all the Tryals I have made, very little Light appears, tho' in the darkeſt Room; and the beſt time of making theſe Experiments, is when the Sun is 18 Degrees below the Horizon; and when the Sun is ſo, tho' the Moon ſhines never ſo bright, the Light is the ſame as in the darkeſt Room, which makes me chuſe to call it a *Noctiluca*.

I will not preſume to give you my Thoughts concerning Amber, (which ſeems to be a Receptacle, and an inexhauſtible Treaſure of Light;) why upon a hard friction the Light ſhould, as it were, be ſtrain'd out of ſuch a number of places? Nor why upon an eaſie friction it ſhou'd not give thoſe Cracklings and Light, unleſs the Finger, or ſome other Body, be held at a little diſtance from it? Nor why in a dark Room, tho' it Crackles, it ſhou'd give little or no Light till the Sun is near down? But I have mention'd theſe few things, amongſt many others, to ſee if I cou'd provoke you, *Sir*, to give me your Thoughts about them, not knowing any one ſo capable of doing it as your ſelf: And the Friendſhip you have always profeſs'd to me, makes me hope you'll be pleas'd to excuſe this irregular account of my Obſervations, for you have 'em in the ſame order juſt as I made 'em.

As the Artificial *Phoſphorus* led me to that of Amber, ſo Amber directed me to that of a *Diamond*, from its being Electral as well as the other, which is alſo a Natural *Phoſphorus*, or rather a *Noctiluca*, exceeding all others, and may, without any Exception, be call'd a Mineral *Phoſphorus*, it being, as I think, the moſt pure of all *Oleoſums*, coagulated with a Mineral *Acidum*; and if in the Diſcovery of this I have not oblig'd the Learned, I'm in hopes I ſhall all thoſe who deal in Diamonds; for none of the many I have talk'd withal know any thing of the Matter; tho' Mr. *Boyle* has given the World an Account, at the latter end of his *Book of Colours*, of Mr. *Clayton's* Diamond,

Diamond, and afterwards ſays, that ſome Diamonds wou'd, and ſome wou'd not ſhine in the Dark: But if any one elſe has ſince then made a Diſcovery, that all Diamonds wou'd give Light in the Dark, they have been very unkind to the World in not letting them know it, becauſe I'm well aſſur'd that a great many People have been but too often cheated with 'em, which I hope to prevent for the future; but thus much I muſt take leave to ſay, that I never underſtood any ſuch thing till I diſcover'd it my ſelf, tho' now I remember, that Mr. *Boyle* ſeveral times ſpoke to me of Mr. *Clayton*'s Diamond, lamenting that he cou'd not prevail with the Owner to part with it at any rate. I have now by me a yellow Diamond, which I have ſhewn to a great many Jewellers and others, and but a very few of 'em will allow it to be a Diamond; but by as many Tryals as I have made, I think my way of diſtinguiſhing Diamonds is ſo certain, that none need fear to affirm 'em to be ſo, even upon Oath.

A Diamond, by an eaſie ſlight friction in the Dark, with any ſoft Animal Subſtance, as the Finger, Woollen, Silk, *&c.* appears in its whole Body to be Luminous; nay, if you keep rubbing for a little while, and then expoſe it to the Eye, 'twill remain ſo for ſome little time: But if the Sun be 18 Degrees below the Horizon, if any one holds up a piece of Bays or Flannel ſtretch'd tight between both hands, at ſome diſtance from the Eye, and another rubs the Bays or Flannel with a Diamond ſwiftly and pretty hard on the other ſide of it, the Light to the Eye of him that holds it, ſeems much more pleaſant and perfect than any other way I have yet try'd. But what to me ſeems more ſurprizing than all I have mention'd, is, that a Diamond being expos'd to the open Air in view of the Sky, gives almoſt the ſame Light of it ſelf without rubbing, as if rubb'd in a dark Room; and if in the

open Air you put your hand or any thing elſe a little over it, to hinder its Communication with the Sky, it gives no Light: And I do aſſure you, I have try'd all or moſt of the other Precious Stones, but could find no ſuch *Phænomenon* in any of them; and I muſt further add, that all the Experiments here related were made at the latter end of *May* and beginning of *June*, and therefore I can't pretend to account for the *Phænomena* that may attend Experiments made while the Sun is on the other ſide of the *Equator*.

There are ſome other Bodies that afford Light, and perhaps many more remain yet undiſcover'd, but I'm well aſſur'd, that all or moſt of the Bodies which have an Electricity yield Light; for in my Opinion, 'tis the Light that is in 'em, which is the cauſe of their being Electral, yet this Electricity never ſhows it ſelf without friction; if you rub any Body that has an Electricity, and apply it near to ſome light Bodies, as particularly very thin Slices of Cork, 'twill put them into a great Agitation, and make them ſeem to the Eye as hanging at the Body by a fine Hair.

I forbear ſpeaking of Jet, which ſeems to me to be a black Amber, having moſt of the Properties of Amber, but not ſo perfect and pure.

I muſt not forget to ſpeak of another Subſtance ſo frequently made uſe of by almoſt all ſorts of People, not hitherto by any, I as know, taken notice of to be endu'd with a luminous Quality, which is alſo another Natural *Phoſphorus*, or *Noctiluca*, and that is *Gum Lac*, and alſo Red Sealing-Wax, which is made with *Gum Lac* and *Cinabar*, the *Cinabar*, no way impeding, but rather promoting its Luminous Quality, for I caus'd long taper Rolls to be made up of *Lac* alone, and of pure Red Sealing-Wax, both being well poliſh'd: The Sealing-Wax upon friction, ſeems to me to emit its Crackling and Light ſooner than the *Lac*, which

I impute to the *Cinabar's* conſtringing its parts, tho' I think *Lac per ſe* has the greateſt Electricity, both having all or moſt of the Properties of Amber; and by all the Tryals I have hitherto made of *Lac* and Sealing-Wax, I find that tho' the Cracklings are as plentiful in the day time, as when the Sun is down, yet in the darkeſt Places I cou'd diſcover but a little appearance of Light, ſo that this deſerves the Name of a *Noctiluca* or *Phoſphorus*, as well as the others already ſpoken of, it being no other than a Vegetable *Oleoſum* coagulated with an Animal Volatile *Acidum*. I don't know in the Animal Kingdom, any thing but Piſmires that affords a Volatile Acid, and in the *Eaſt-Indies* there's a large kind of em, that live on the Sap of certain Plants, affording both a Gum and a Colour, which Sap paſſing thro' the Body of thoſe Inſects or Animals, is by their Acid Spirit converted into an Animal Nature; which is the reaſon that with the Colour extracted from *Gum Lac* (which *Gum Lac* is nothing elſe but the Excrements of theſe Inſects or Animals) almoſt as good and full as laſting Colours are made as from *Cochinele*: I'm the more confirmed herein, becauſe I know of an Artificial way of converting Vegetable Colours into an Animal Nature very much like this, by which the Colours are made more pleaſant and permanent, the Method whereof I ſhall forbear mentioning at preſent, and refer it to what I may hereafter have occaſion to write in relation to Colours. After the ſame manner the remaining Gum, which is an *Oleoſum*, being digeſted and paſſing thro' the Bodies of thoſe Inſects or Animals, is by their Volatile Acid converted into a Vegetable-Animal *Phoſphorus*, or *Noctiluca*; the Artificial *Phoſphorus* is a Mineral-Animal *Phoſphorus*, whereas I take the others to be altogether Mineral.

Perhaps, *Sir*, this haſty and ſhort Account of my Obſervations may by ſome be thought little better than a

Trifle, ſo might probably be the attraction of Iron by the Loadſtone, when that was the firſt obſervable *Phænomenon* in it; which tho' ſmall in it ſelf, yet gave to the Curious an occaſion of finding out the other Properties of that Mineral, which have been ſince improv'd to an Univerſal Benefit in the diſcovery of new Arts and new Worlds. And I am not without hopes but that ſome more elevated and happy Genius may ariſe, under whoſe Conduct theſe Hints may be carry'd on to an height not eaſie to be foreſeen by Perſons of ſhort Views, whoſe Conceptions are confin'd within the narrow limits of what's already known, and whoſe Self-ſufficiency ſooths 'em with a *Ne plus ultra*.

Thus, *Sir*, I pleaſe my ſelf with the remote proſpect of new Scenes in Nature, which, tho' imperfect at preſent, may in time by ſome skilful Hand be finiſh'd and fitted for a nearer view, tho' before that time ſhall come, nothing may remain of me beſides this Teſtimony of my good Will to Mankind, and particular reſpect for you.

ADVER-